

WHAT IS CLAIMED IS:

1. A demodulation circuit for demodulating a digital transmission signal, wherein

a preliminarily known signal being inserted in said  
5 digital transmission signal upon transmission,

said demodulation circuit comprising:

A/D converting means for performing A/D conversion of a base band signal obtained by demodulation of said digital transmission signal; and

10 phase shifting means for causing phase shift of one of said digital transmission signal and said base band signal on the basis of said known signal after digital conversion by said A/D converting means and said known signal upon transmission.

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2. A demodulation circuit as set forth in claim 1, which further comprises orthogonal demodulating means for performing orthogonal demodulation of said digital transmission signal formed with an orthogonal modulated  
20 signal,

said A/D converting means includes two A/D converters for performing A/D conversion of two base band signals demodulated by said orthogonal demodulating means and having demodulated phases mutually offset for right angle,

25 symbol judgment portion for making judgment of symbols of digital signals converted by said two A/D converters ,  
said phase shifting means including comparing portion

for comparing said known signal, for which symbol judgment  
is performed by said symbol judgment portion with said known  
signal for transmission, and a phase shifter for causing  
phase shift of said base band on the basis of a result of  
5 comparison by said comparing portion.

3. A demodulation circuit as set forth in claim 1, which  
further comprises orthogonal demodulating means for  
performing orthogonal demodulation of said digital  
10 transmission signal formed with an orthogonal modulated  
signal,

said A/D converting means includes two A/D converters  
for performing A/D conversion of two base band signals  
demodulated by said orthogonal demodulating means and having  
15 demodulated phases mutually offset for right angle,

symbol judgment portion for making judgment of symbols  
of digital signals converted by said two A/D converters,

said phase shifting means including P/S converter for  
converting the digital signal, for which symbol judgment is  
20 performed by said symbol judgment portion, comparing portion  
for comparing said known signal serial converted by said P/S  
converter with said known signal for transmission and a phase  
shifter for causing phase shift of said base band on the basis  
of a result of comparison by said comparing portion.

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4. A demodulation circuit as set forth in claim 3, which  
further comprises reception data processing portion

obtaining an information data by removing said known signal from the signal converted into a serial data by said P/S converter.

5     5.     A demodulation circuit as set forth in claim 2, wherein said phase shifter causes phase shift of said digital transmission signal on the basis of the result of comparison by said comparing portion.

10    6.     A demodulation circuit as set forth in claim 1, wherein said phase shifting means outputs different phase shifting amount for N times, (in which N is an integer greater than or equal to two), for detecting shifting amount to be shifted on the basis of the result of comparison of the known signals  
15    for N times with respect to respective phase shifting amounts.

7.     A demodulation circuit as set forth in claim 6, wherein said phase shifting means causes phase shift to a phase where  
20    a correlation value of said known signal for transmission and said known signal after digital conversion by said A/D converting means becomes the highest.

8.     A demodulation circuit as set forth in claim 6, wherein  
25    said phase shifting means repeats a process for detecting phase amount to be shifted based on the result of comparison for N times for M times, in which M is positive integer to

take an average value of optimal phase shifting amount for M times as a final optimal phase shifting amount.

9. A demodulation circuit as set forth in claim 1, wherein  
5 said digital transmission signal is a signal, in which said information data and said known signal are time multiplexed.

10. A demodulation circuit as set forth in claim 1, wherein  
10 said digital transmission signal has two base band signals having phases mutually shifted for  $90^\circ$ , in which an information data is assigned for one of said base band signals and said known signal is assigned to the other base band signal.

15 11. A modulation circuit for modulating a digital signal comprising:

known signal inserting means for inserting a preliminarily known signal to said digital signal; and

modulating means for modulating the digital signal  
20 after insertion of said known signal.

12. A modulation circuit as set forth in claim 11, wherein said modulating means is an orthogonal modulator.

25 13. A modulation circuit as set forth in claim 11, wherein said known signal inserting means inserts said known signal to said digital signal in time multiplexing.

14. A modulation circuit as set forth in claim 11, wherein  
said known signal inserting means assigns information data  
to one of two digital signals which are modulated to have  
5 phases mutually shifted for  $90^\circ$  and said known signal to the  
other digital signal.

15. A demodulation method for demodulating a digital  
transmission signal, wherein  
10 a preliminarily known signal being inserted in said  
digital transmission signal upon transmission,  
said demodulation method comprising:  
first step of performing A/D conversion of a base band  
signal obtained by demodulation of said digital transmission  
15 signal; and  
second step causing phase shift of one of said digital  
transmission signal and said base band signal on the basis  
of said known signal after digital conversion in said first  
step and said known signal upon transmission.

20 16. A demodulation method as set forth in claim 15, which  
further comprises third step of performing orthogonal  
demodulation of said digital transmission signal formed with  
an orthogonal modulated signal,  
25 said first step includes first sub-step of performing  
A/D conversion of two base band signals demodulated by said  
third step and having demodulated phases mutually offset for

90° , and making judgment of symbols of digital signals converted by said two A/D converters ,

5       said second step including second sub-step of comparing said known signal, for which symbol judgment is performed by said first sub-step with said known signal for transmission, and third sub-step of causing phase shift of said base band on the basis of a result of comparison by said second sub-step.

10   17.   A demodulation method as set forth in claim 15, which further comprises third step of performing orthogonal demodulation of said digital transmission signal formed with an orthogonal modulated signal,

15       said first step includes first sub-step of performing A/D conversion of two base band signals demodulated by said third step and having demodulated phases mutually offset for 90° , and making judgment of symbols of digital signals converted by said two A/D converters ,

20       said second step including fourth sub-step conversing the digital signal, for which symbol judgment is performed by said symbol judgment portion, second sub-step of comparing said known signal serial converted by said fourth sub-step with said known signal for transmission and third sub-step of causing phase shift of said base band on the basis of a  
25   result of comparison by said fifth sub-step.

18. A demodulation method as set forth in claim 17, which further comprises fourth step of obtaining an information data by removing said known signal from the signal converted into a serial data by said fourth sub-step.

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19. A demodulation method as set forth in claim 16, wherein said second step causes phase shift of said digital transmission signal on the basis of the result of comparison by said second sub-step.

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20. A demodulation method as set forth in claim 15, wherein said second step outputs different phase shifting amount for N times, (in which N is an integer greater than or equal to two), for detecting shifting amount to be shifted on the basis of the result of comparison of the known signals for N times with respect to respective phase shifting amounts.

21. A demodulation method as set forth in claim 20, wherein said second step causes phase shift to a phase where a correlation value of said known signal for transmission and said known signal after digital conversion in said first step becomes the highest.

22. A demodulation method as set forth in claim 20, wherein said second step repeats a process for detecting phase amount to be shifted based on the result of comparison for N times for M times, in which M is positive integer to take an average

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value of optimal phase shifting amount for M times as a final optimal phase shifting amount.

23. A demodulation method as set forth in claim 15, wherein  
5 said digital transmission signal is a signal, in which said information data and said known signal are time multiplexed.

24. A demodulation method as set forth in claim 15, wherein  
said digital transmission signal has two base band signals  
10 having phases mutually shifted for  $90^\circ$ , in which an information data is assigned for one of said base band signals and said known signal is assigned to the other base band signal.

15 25. A modulation circuit for modulating a digital signal comprising:

fifth step of inserting a preliminarily known signal to said digital signal; and

sixth step of modulating the digital signal after  
20 insertion of said known signal.

26. A modulation method as set forth in claim 25, wherein said modulating means is an orthogonal modulator.

25 27. A modulation method as set forth in claim 25, wherein said fifth means inserts said known signal to said digital signal in time multiplexing.



28. A modulation method as set forth in claim 25, wherein  
said fifth step assigns information data to one of two digital  
signals which are modulated to have phases mutually shifted  
5 for 90° and said known signal to the other digital signal.